SERVICE MANUAL

MODEL FG-8102
SWEEP/FUNCTION GENERATOR

UNISOURCE CORPORATION

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1. PERFORMANCE CHECK PROCEDURE

1-1. General

This section contains the Procedures required to check and maintain specified instrument performance. The adjustments should be performed at an ambient temperature of 25°C ±2°C and a relative humidity of less than 60%. It allows the instrument to stabilize at this environment for a minimum of 30 minutes.

1-2. Equipment's required

Table 1-1 is shown test equipment's required.

Table 1-1 Equipment's required

No.	Equipment name	Specification	Remark
1.	Frequency Counter	DC to 60 MHz	
2.	Oscilloscope	DC to 20 MHz	
3.	AC Millivolt Meter	Up to 30 Vrms	
4.	Distortion Analyzer		
5.	DC Power Supply	DC 0 to 10V	
6.	Signal Generator	200mHz to 50 MHz	
7.	FEEDTHROUGH TERMINATION 50 Ω		

1-3. Performance check

1-3-1. OUTPUT FREQUENCY RANGE

SPECIFICATION

0.02 Hz TO 2 MHz

ACCURACY

+/- 5 % OF SETTING

EQUIPMENT

FREQUENCY COUNTER
BNC CABLE
FEEDTHROUGH TERMINATION 50 Ω (if necessary)

PROCEDURE

2. Set 8202 as follows;
   - Function ; SINE WAVE (∿)

- ATT ; 0 dB(PULL OUT)
- AMPLITUDE ; CENTER
- COUNT ; INT(PULL OUT)
- DC OFFSET ; OFF(PUSH IN)
- SYM ; OFF(PUSH IN)
- SWEEP ; OFF(PUSH IN)

2. Connect the frequency counter to output terminal.
3. Set the frequency counter to frequency measurement.
4. Set the output frequency of this product by FREQUENCY RANGE and DIAL and verify counter frequency reading as follows;

8202 setting		Counter reading
Range	Frequency	
1M	2.000 MHz 20.00 kHz	
100k	200.0 kHz 2.000 kHz	
10k	20.00 kHz 200.0 Hz	
1k	2.000 kHz 20.00 Hz	
100	200.0 Hz 2.000 Hz	
10	20.00 Hz 200.0 mHz	
1	2.000 Hz 20.00 mHz	

** For reading less than 200 mHz, you can read by period value.
200mHz ; 5.000 sec
20 mHz ; 50.000 sec

1-3-2. AMPLITUDE AND ATTENUATION

SPECIFICATION

Amplitude range ;100mVp-p to 10Vp-p IN TO 50Ω
Attenuation ;20 dB

ACCURACY

Lower than 100mVp-p(IN TO 50Ω) at MIN.
Higher than 10Vp-p(IN TO 50Ω) at MAX.

EQUIPMENT

Oscilloscope
AC Millivoltmeter
BNC CABLE
FEEDTHROUGH TERMINATION 50 Ω

PROCEDURE

1. Set this product as follows;
   - Function ; SINE WAVE (∿)
   - ATT ; 0 dB(PULL OUT)
   - AMPLITUDE ; CENTER
   - COUNT ; INT(PULL OUT)
   - DC OFFSET ; OFF(PUSH IN)
   - SYM ; OFF(PUSH IN)
   - SWEEP ; OFF(PUSH IN)
2. Connect the oscilloscope through FEEDTHROUGH TERMINATION 50 Ω to output terminal.
3. Set Amplitude Control to Min. position and check the output level is lower than 100mVp-p(less 5div in 20mV/div).
4. Set Amplitude Control to Max. position and check the output level is higher than 10Vp-p(higher than 4div in 5V/div).
5. Set Amplitude Control to Min. position and connect AC Millivoltmeter to output terminal.
6. Set the Range of AC millivoltmeter to 3V range and adjust Amplitude control for 0dB reading on AC millivoltmeter.
7. Push in “20dB ATT switch” and check the reading of AC Millivoltmeter is -20 dB.

1-3-3. SINE WAVE CHARACTERISTICS

SPECIFICATION

Total harmonic Distortion(THD) ; ≤ 1 % (10Hz to 100kHz)

EQUIPMENT

Distortion analyzer
BNC CABLE
FEEDTHROUGH TERMINATION 50 Ω (if necessary)

PROCEDURE

1. Set this product as follows;
   - Function ; SINE WAVE (∿)
   - ATT ; 0 dB(PULL OUT)
   - AMPLITUDE ; CENTER

- COUNT ; INT(PULL OUT)
- DC OFFSET ; OFF(PUSH IN)
- SYM ; OFF(PUSH IN)
- SWEEP ; OFF(PUSH IN)

2. Connect the distortion analyzer to output terminal.
3. Check the distortions of output signal are less than 1% from 10Hz to 100kHz.

1-3-4. TRIANGLE/SQUARE WAVE CHARACTERISTICS

SPECIFICATION

Linearity of Triangle Wave ; ≥ 99 % (10Hz to 100kHz)
Rise and Fall Time of Square Wave ; Less than 140nS

EQUIPMENT

Oscilloscope
BNC CABLE
FEEDTHROUGH TERMINATION 50 Ω (if necessary)

PROCEDURE

1. Set this product as follows;
   - Function ; TRIANGLE WAVE (⋀⋁)
   - ATT ; 0 dB(PULL OUT)
   - AMPLITUDE ; CENTER
   - COUNT ; INT(PULL OUT)
   - DC OFFSET ; OFF(PUSH IN)
   - SYM ; OFF(PUSH IN)
   - SWEEP ; OFF(PUSH IN)
2. Connect the oscilloscope to output terminal.
3. Check the linearity of Triangle wave from 10Hz to 100kHz.
4. Change the function to “SQUARE WAVE(⎍)” and check the rise and fall time from 10Hz to 100kHz.

1-3-5. TTL/CMOS OUTPUT

SPECIFICATION

TTL OUTPUT - Rise and Fall Time ; Less than 140nS
- Output Level ; TTL LEVEL (H ≥ 2.4V , L ≤ 0.4V)

CMOS OUTPUT - Rise and Fall Time ; Less than 140nS(max. out)
- Output Level ; 4V TO 15V , VARIABLE

EQUIPMENT

Oscilloscope
BNC CABLE

PROCEDURE

1. Set this product as follows;
   - FREQ. RANGE ; 10k
   - FREQ. DIAL ; 10kHz
   - COUNT ; INT(PULL OUT)
   - DC OFFSET ; OFF(PUSH IN)
   - SYM ; OFF(PUSH IN)
   - SWEEP ; OFF(PUSH IN)
   - TTL/CMOS ; TTL(PUSH IN)
3. Set the oscilloscope to 1V/div, 5uS/div and connect to TTL/CMOS output terminal.
4. Check the TTL SQUARE WAVE on CRT(5div).
5. Pull out TTL/CMOS control and adjust from Min. to Max. position.
6. Check the output level is varied from 4V to 15V.

1-3-5. DC OFFSET CONTROL

SPECIFICATION

MIN. ; lower than -10 V DC (Open circuit)

MAX. ; higher than +10 V DC (Open circuit)

EQUIPMENT

Oscilloscope

BNC CABLE

PROCEDURE

1. Set this product as follows;
   - Function ; SQUARE (⎍)
   - ATT ; 0 dB(PULL OUT)
   - FREQ. RANGE ; 10k
   - FREQ. DIAL ; 10kHz
   - AMPLITUDE ; CENTER

2. Set Oscilloscope to 5V/DIV, 10uS/DIV, DC Coupling and connect to output terminal.
3. Adjust Amplitude Control for 2DIV on CRT.
4. Pull out “DC OFFSET” Control and set to “MIN.” position and check the DC OFFSET level is lower than -10V(Lower than -2DIV).
5. Set “DC OFFSET” Control to “MAX.” position and check the DC OFFSET level is higher than +10V(Higher than +2DIV).

1-3-6. SYMMETRY CONTROL

SPECIFICATION

MIN. ; lower than 1:10
MAX. ; higher than 10:1

EQUIPMENT
Oscilloscope
BNC CABLE
FEEDTHROUGH TERMINATION 50 Ω (if necessary)

PROCEDURE
1. Set this product as follows;
   - Function ; SQUARE (⊓⊔)
   - ATT ; 0 dB(PULL OUT)
   - AMPLITUDE ; CENTER
   - COUNT ; INT(PULL OUT)
   - DC OFFSET ; OFF(PUSH IN)
   - SYM ; OFF(PUSH IN)
   - SWEEP ; OFF(PUSH IN)
2. Connect the oscilloscope to output terminal.
3. Set the output frequency to 20kHz.
4. Pull out SYM Control and adjust to Min. position. And check the symmetry(duty ratio) is “lower than 1:10”.
5. Adjust SYM Control to Max. position and check the symmetry(duty ratio) is”higher than 10:1”.

1-3-7. SWEEP FUNCTION

SPECIFICATION
Sweep Width ; 1:1 to 100:1
Sweep Rate ; 0.5Hz to 50Hz(20mS to 2 S)

EQUIPMENT
Oscilloscope
Frequency Counter
BNC CABLE
FEEDTHROUGH TERMINATION 50 Ω (if necessary)

PROCEDURE
1. Set this product as follows;
   - Function ; SINE WAVE (∿)
   - ATT ; 0 dB(PULL OUT)
   - AMPLITUDE ; CENTER
   - COUNT ; INT(PULL OUT)
   - DC OFFSET ; OFF(PUSH IN)

- SYM ; OFF(PUSH IN)

2. Connect the oscilloscope and Frequency Counter to output terminal.
3. Set Freq. Range to 10k and adjust Freq. Dial to 200Hz (Start Frequency).
4. Pull out SWIDTH Control and adjust to max. position (20kHz, Stop frequency).
5. Adjust Sweep Rate Control for desired rate and check sweep operating.

1-3-8. VCF IN FUNCTION

SPECIFICATION

Out-put frequency should be changed from minimum frequency to maximum frequency in each frequency range by changing VCF INPUT Voltage from 0 to 10V DC.

EQUIPMENT

Power supply
BNC CABLE

PROCEDURE

1. Set this product as follows;
   - Function ; SINE WAVE (∿)
   - Frequency Range ; 10K
   - Frequency Control ; Max.
   - ATT ; 0 dB(PULL OUT)
   - AMPLITUDE ; CENTER
   - COUNT ; INT(PULL OUT)
   - DC OFFSET ; OFF(PUSH IN)
   - SYM ; OFF(PUSH IN)
2. Set Power Supply to “0V” and connect to “VCF IN” Terminal.
3. Check the output frequency is “200Hz ± 20Hz”.
4. Increase the output voltage of Power Supply up to +10V and check the output frequency as following table.

VCF Voltage	Output Frequency	Tolerance
0	200.0 Hz	± 20Hz
2.000 V	4.000 kHz	± 400Hz
4.000 V	8.000 kHz	± 800Hz
6.000 V	12.00 kHz	± 1.2 kHz
8.000 V	16.00 kHz	± 1.6 kHz
10.00 V	20.00 kHz	± 2.0 kHz

1-3-9. FREQUENCY COUNTER

SPECIFICATION

Frequency range ; 200mHz to 50MHz
Input sensitivity ; 100mVrms

EQUIPMENT

Signal generator

PROCEDURE

1. Set the COUNT to EXT(PUSH IN).
2. Connect the signal generator to EXT COUNT IN terminal.
3. Set the signal generator to 100mVrms, 200mHz and check the reading of 8202.
4. Vary the output frequency from 200mHz to 50MHz and check the 8202 displays correct frequencies.
5. Push in LPF(Low Pass Filter) and check the LPF is working (-3dB +/-0.2dB point at approx. 120kHz).

   < Check procedure >

   a. Apply 120KHz signal with minimum input level into EXT COUNT IN.

   b. Push in LPF switch and check gate time(Frequency display) is stopped.

   c. Increase input level and check the gate time(Frequency display) is starting to and check the input level is increased about 3dB(+/-0.2dB) from “a”.

2. ADJUSTMENT PROCEDURE

2-1. Preliminary Set-up

Remove top cover. Apply power, and allow at least 30 minutes for warm-up.

2-2. Power supply

a. Check the voltage in each position according to table 2-1.

Table 2-1 Power supply outputs

Check position	Supplying Voltage	Tolerance	Remark
Pin no. 5 of u4	+ 5 V	± 0.5V	
Right leg of C61	+ 5 V	± 0.5V	
Anode of ZD1	- 5 V	± 0.5V	
Pin no. 4 of U2	+ 15 V	± 1 V	
Pin no. 11 of U2	- 15 V	± 1 V	
Upper leg of R68	+ 22 V	± 2 V	
Right leg of R67	- 22 V	± 2 V	

2-4. PRE-ADJUSTMENTS

2-4-1. TRIANGLE WAVE OFFSET, SQUARE & SINE WAVE LEVEL ADJUST

EQUIPMENT

Oscilloscope

BNC CABLE
FEEDTHROUGH TERMINATION 50 Ω (if necessary)

PROCEDURE

1. Set this product as follows;
   - Function ; TRIANGLE WAVE (⋀)
   - ATT ; 20 dB(PUSH IN)
   - AMPLITUDE ; MIN.
   - FREQUENCY ; 10kHz
   - COUNT ; INT(PULL OUT)
   - DC OFFSET ; OFF(PUSH IN)
   - SYM ; OFF(PUSH IN)
2. Set the oscilloscope to 0.5V/DIV, 5uS/DIV , DC Coupling and set the vertical position to horizontal graticule center.
3. Connect the oscilloscope to output terminal.
4. Set "AMPLITUDE" control for 2DIV on CRT and adjust SFR14(OFFSET ADJUSTER) for "0 OFFSET of waveform"(The waveform should be in center. +/- 1DIV from horizontal graticule center).
5. Change the function to "SQUARE WAVE (⊓⊔)" and adjust SFR9 for displaying "2DIV(± 1DIV from horizontal graticule center)" on CRT.
6. Change the function to "SINE WAVE (∿)" and adjust SFR10 , SFR13 for displaying "2DIV" on CRT. (SFR10 : + 1DIV from horizontal graticule center for up-side of waveform , SFR13 : - 1DIV from horizontal graticule center for down-side of waveform)

2-4-2. SINE WAVE DISTORTION ADJUST

EQUIPMENT

Distortion Analyzer
BNC CABLE
FEEDTHROUGH TERMINATION 50 Ω (if necessary)

PROCEDURE

1. Set this product as follows;
   - Function ; SINE WAVE (∿)
   - ATT ; 20 dB(PUSH IN)
   - AMPLITUDE ; Max.
   - FREQUENCY ; 10kHz
2. Connect Distortion analyzer to Output terminal.
3. Adjust SFR8, SFR11, SFR12 for minimum distortion reading on Distortion analyzer. **(less than 0.5 %)**

2-4-3. AMPLITUDE CONTROL AND ATTENUATOR CHECK

EQUIPMENT

Oscilloscope
AC Millivoltmeter
BNC CABLE
FEEDTHROUGH TERMINATION 50 Ω

PROCEDURE

1. Set this product as follows ;
   - Function ; SINE WAVE (∿)
   - ATT ; 0 dB(PULL OUT)
   - AMPLITUDE ; CENTER
   - COUNT ; INT(PULL OUT)
   - DC OFFSET ; OFF(PUSH IN)
   - SYM ; OFF(PUSH IN)
   - SWEEP ; OFF(PUSH IN)
2. Connect the oscilloscope through FEEDTHROUGH TERMINATION 50 Ω to output terminal.
3. Set Amplitude Control to Min. position and check the output level is lower than 100mVp-p(less 5div in 20mV/div).
4. Set Amplitude Control to Max. position and check the output level is higher than 10Vp-p(higher than 4div in 5V/div).
5. Set Amplitude Control to Min. position and connect AC Millivoltmeter to output terminal.
6. Set the Range of AC millivoltmeter to 3V range and adjust Amplitude control for 0dB reading on AC millivoltmeter.
7. Push in “20dB ATT switch” and check the reading of AC Millivoltmeter is -20 dB.
8. Check the amplitude of TRIANGLE & SQUARE WAVE same as paragraph 3 to 7.

2-5. FREQUENCY RANGE ADJUSTMENT

EQUIPMENT

Frequency Counter
BNC CABLE
FEEDTHROUGH TERMINATION 50 Ω

PROCEDURE

1. Set this product as follows;
   - Function ; TRIANGLE WAVE (△)
   - ATT ; 20 dB(PUSH IN)
   - AMPLITUDE ; CENTER
   - COUNT ; INT(PULL OUT)
   - DC OFFSET ; OFF(PUSH IN)
   - SYM ; OFF(PUSH IN)
   - SWEEP ; OFF(PUSH IN)

2. Connect the Frequency Counter to Output Terminal.
2. Set Frequency Range to “1M” and Frequency Control(Dial) to MAX. Position.
3. Adjust SFR1 for 2.100 MHz frequency reading on counter.
4. Change Frequency Range to “100k” and adjust SFR2 for 210.00 kHz frequency reading on counter.
5. Change Frequency Range to “10k” and adjust SFR3 for 21.000 kHz frequency reading on counter.
6. Change Frequency Range to “1k” and adjust SFR4 for 2.1000 kHz frequency reading on counter.
7. Change Frequency Range to “100” and adjust SFR2 for 210.00 Hz frequency reading on counter.
8. Change the frequency range to 10 and 1, and check the frequency reading in each range. (10 : 21.000 Hz , 1 : 2.1000 Hz)
9. After adjustment, check the frequency Control(Dial) at MIN. and MAX. as following table.

7202 setting		Tolerance
Range	Frequency Control	
1M	MIN. MAX.	Less than 19 kHz Higher than 2.1 MHz
100k	MIN. MAX.	Less than 1.9 kHz Higher than 210 kHz
10k	MIN. MAX.	Less than 190 Hz Higher than 21 kHz
1k	MIN. MAX.	Less than 19 Hz Higher than 2.1 kHz
100	MIN. MAX.	Less than 1.9 Hz Higher than 200 Hz
10	MIN. MAX.	Less than 190 mHz Higher than 21 Hz
1	MIN. MAX.	Less than 19 mHz Higher than 2.1 Hz

2-6. SYMMETRY ADJUST

EQUIPMENT

Oscilloscope
BNC CABLE
FEEDTHROUGH TERMINATION 50 Ω (if necessary)

PROCEDURE

1. Set this product as follows;
   - Function ; SQUARE (⎍)
   - ATT ; 0 dB(PULL OUT)
   - AMPLITUDE ; CENTER
   - COUNT ; INT(PULL OUT)

- DC OFFSET ; OFF(PUSH IN)
- SYM ; OFF(PUSH IN)
- SWEEP ; OFF(PUSH IN)

2. Connect the oscilloscope to output terminal.
3. Set the output frequency to 20kHz.
4. Pull out SYM Control and adjust to Min. position. And adjust SFR6 the symmetry(duty ratio) is “lower than 1:10”.
5. Adjust SYM Control to Max. position and adjust SFR7 the symmetry(duty ratio) is”higher than 10:1”.

2-7. FREQUENCY COUNTER ADJUST

EQUIPMENT

10MHz Standard Signal Source
Signal Generator up to 50MHz
BNC CABLE
FEEDTHROUGH TERMINATION 50 Ω (if necessary)

PROCEDURE

1. Set this product as follows;
   - COUNT ; EXT(PUSH IN)
2. Connect 10MHz Standard Signal to the EXT COUNT IN terminal and adjust TC1 for 10.0000 MHz reading on Counter Display.
3. Set Signal generator to 50MHz, 100mVrms and connect the EXT COUNT IN terminal.
4. Adjust SFR16 for 50.0000 MHz reading on Counter Display. Reduce the output level of Signal Generator Slowly and adjust SFR16 for Minimum input sensitivity(as possible as less than 100mVrms).
5. Change the out frequency of Signal Generator from 50MHz to 200mHz and check the minimum input voltage is less than 100mVrms.
6. Push in LPF(Low Pass Filter) and check the LPF is working (-3dB +/-0.2dB point at approx. 120kHz).
   < Check procedure >
   a. Apply 120KHz signal with minimum input level into EXT COUNT IN.
   b. Push in LPF switch and check gate time(Frequency display) is stopped.
   c. Increase input level and check the gate time(Frequency display) is starting to and check the input level is increased about 3dB(+/-0.2dB) from “a”.

3. Troubleshooting Procedure

3-1. Troubleshooting techniques

3-1-1. Check the function selector and switch setting. Incorrect switch settings can give a false indication of instrument malfunction. If there is any question about the correct function or operation, refer to OPERATOR'S MANUAL.

3-1-2. Check associated equipments
Before proceeding, ensure that any equipments used with this product is operating correctly and verify that out and input signals are properly connected and that the interconnecting cables are not defective.

3-1-3. Visual Check
Look for broken terminals, damaged components, mounting status of components, damaged circuit boards, or other clues to the cause of a malfunction.

3-2. Troubleshooting procedure

3-2-1. NO Display

1. Check the “FUSE” and if it is broken, change to new one with same rating.
2. Check the output voltage of power transformer.
   - -. 20 to 24 Vac between pin 1 and 2 of CN14, and between pin 2 and 3 of CN14 on main board.
   - -. 6 to 8 Vac between pin 1 and 2 of CN4, and between pin 2 and 3 of CN4 on main board.
3. Check the DC Power Voltage.
   - -. +5VDC at U15 output(U15 Assembled at rear panel)
4. Check the frequency at pin 19 of U12. It should be “10MHz”.
5. Check the connector cable from CN12,CN13(main board) to display board.

3-2-2. Triangle Wave Out-put

1. Check the Function switch operation and select Triangle Wave.
2. Check the DC Power Voltage for Generator Circuit.
   - -. +15VDC at U5 output
   - -. +5VDC at U6 output
   - -. -5VDC at C27 -
   - -. -15VDC at U7 output
   - -. +21VDC at C20 +
   - -. -21VDC at C26 -

3. Check the waveform at Q7 Emitter. The Triangle Wave should be appeared.
4. If not, check the operation of Amplifier and Triangle oscillator (U1 A/B/D, U2 A/B, Q3,Q4,Q5,Q6,D3,D4,D5,Q7).
5. Check the Range Selector Switch operation and Frequency Control Volume and Cable connection from VR1 to CN2(Main Board).
6. Check the "Amplitude VR" and Cable connection from VR to CN5 on main board.
7. Check the waveform at R62. The Triangle Wave should be appeared.
8. If not, check the operation of Differential Amplifier(Q12,Q13,Q14,Q15,Q16).
9. Check the Attenuator switch(20 dB) and cable connection from CN7 to Output terminal.

3-2-3. Square Wave Out-put

1. Check the Function switch operation and select Square Wave.
2. Check the waveform at D1 Anode. The Triangle Wave should be appeared.
3. If not, check the step 3-2-2. 4 and 5.
4. Check the waveform at 9pin of U3. The Square Wave should be appeared.
5. If not, check the operation of U3.
6. Check the waveform at R62. The Square Wave should be appeared.
7. If not, check the step 3-2-2. 8 and 9.

3-2-4. Sine Wave Out-put

1. Check the Function switch operation and select Sine Wave.
2. Check the waveform at Q7 Emitter. The Triangle Wave should be appeared.
3. If not, check the step 3-2-2. 4 and 5.
4. Check the waveform at Q11 Collector. The Sine Wave should be appeared.

5. If not, check the operation of Sine Shaper(Q8,Q9,Q10,Q11).
6. Check the waveform at R62. The Sine Wave should be appeared.
7. If not, check the step 3-2-2. 8 and 9.

3-2-5. TTL/CMOS Out-put

1. Check the connection of cable for output terminal and Control Volume.
2. Set to TTL(Push in) and check the waveform at Pin 9 of U3. The Square Wave should be appeared.
3. If not, check the step 3-2-3.
4. Check the waveform at pin 6 of U4. The TTL Level Square Wave should be appeared.
5. If not, check the operation of U4.
6. Set to CMOS(Pull out) and check the waveform at pin 8 of U4. The TTL Level Square Wave should be appeared.
7. Vary the CMOS Level control and check the CMOS level is varied from 5V to 15V at TTL/CMOS output terminal.
8. If not, check the R82,VR7 and cable connection.

3-2-6. Sweep Operation(Width and Rate)

1. Check the cable connection(CN8,CN9) for Width and Rate Control Volume.
2. Vary the Width volume and check the period of Pulse at pin 14 of U2 is varied.
3. Vary the Rate volume and check the level of Pulse at pin 14 of U2 is varied.
4. If not, check the operation of U2 C/D , D9 and Q17.

3-2-7. Frequency Range and Frequency Dial

1. Check the cable connection from CN2(Main Board) to Frequency Control Volume.
2. Check the operation of Range selector switch(Key Switch operation).

3-2-8. Attenuator(20dB)

1. Check the operation of each Attenuator switch.
2. If not working, check the R63,R64,R65.

3-2-9. Frequency Counter(INT/EXT)

1. Check the INT/EXT selector switch operation and set to INT.
2. Check the output frequency at Output terminal by using Frequency counter and check the frequency at R83 is same with output frequency.
3. Check the frequency of reference signal at pin18 and 19 of U12. It should be “10.000MHz”.
4. If not, check Reference Oscillator(X1,T1,C54,C57).
5. Check the frequency at pin3 of U9. It should be same as output frequency.
6. If not, check the operation of Input Amplifier(Q18,Q19,U8,Q20,Q21).
7. Check the cable connection between CN12(main board) and CN13(Display Board).
8. Check the operation of Display Controller(U13,U14,Q22-28) on Display Board.
9. Check LPF function as follows;
   a. Check the status of LPF S/W(push in)
   b. Check the voltage at the left leg of R108. It should be around +5V.
   c. Check the voltage at the anode of D16. It should be around 1.4-1.5V.
   d. Check the voltage at cathode of D16. It should be around on 0.7-0.8V.

4. PARTS LIST

Table 4-1 is shown Parts list.

5. CIRCUIT DIAGRAM

Fig. 5-1 is shown Circuit diagram.

TABLE 4-1. PARTS LIST

1. MAIN BOARD

NO	PART NAME	SPECIFICATION	Q'TY	REFERENCE NUMBER	REMARK
1	CER.CAPACITOR.SMD	4pF50V	1.00	C11	
2	CER.CAPACITOR.SMD	30pF50V	1.00	C54	
3	CER.CAPACITOR.SMD	39pF50V	1.00	C16	
4	CER.CAPACITOR.SMD	68pF50V	1.00	C10	
5	CER.CAPACITOR.SMD	82pF50V	1.00	C9	
6	CER.CAPACITOR.SMD	0.01uF50V(10nF)	12.00	C2,8,15,29,31,33,34,39,45,47,90,91	
7	CER.CAPACITOR.SMD	0.1uF50V(100nF)	8.00	C49-53,56,59,61	
8	CER.CAPACITOR.SMD	130pF50V	2.00	C38,41	
9	CER.CAPACITOR.SMD	150pF50V	1.00	C13	
10	CER.CAPACITOR.SMD	0.22uF50V(220nF)	2.00	C17,18	
11	CER.CAPACITOR.SMD	330pF50V	1.00	C19	
12	CER.CAPACITOR.SMD	470pF50V	1.00	C44	
13	TRIMMER CAPACITOR	CTC05F500,50pF/2READ	1.00	T1	
14	STYROL CAPACITOR	200pF50V	1.00	C3	
15	STYROL CAPACITOR	2200pF50V	1.00	C4	
16	M/F CAPACITOR	0.22uF250V(220nF) J	1.00	C6	
17	M/F CAPACITOR	2.2uF250V(2200nF)	1.00	C7	
18	M/F CAPACITOR	0.047uF250V(47nF) J	1.00	C37	
19	M/F CAPACITOR(BOX)	0.022uF63V(22nF) J	1.00	C5	
20	MYLER CAPACITOR	0.22uF100V(220nF)	1.00	C36	
21	ELEC.CAPACITOR	10uF35V	1.00	C55	
22	ELEC.CAPACITOR	22uF16V	9.00	C1,12,14,22,23,25,30,32,35	
23	ELEC.CAPACITOR	47uF35V	7.00	C27,28,40,42,43,46,48	
24	ELEC.CAPACITOR	1000uF35V	3.00	C21,24,58	
25	ELEC.CAPACITOR	220uF35V	2.00	C20,26	
26	ELEC.CAPACITOR	2200uF35V	1.00	C83	
27	ELEC.CAPACITOR	470uF25V	1.00	C60	
28	SWITCHING DIODE.SMD	1N4148	13.00	D1-11,16,17	
29	RECTIFIER DIODE	1N4004	2.00	D12,13	
30	ZENER DIODE	5.1V 1/2W	1.00	ZD1	
31	BRIDGE DIODE	DF06M	1.00	BD1	
32	WAFER	3pin,LW064003(2.54mm)	2.00	CN 4,14	
33	WAFER	3pin,LW114303(3.96mm)	2.00	CN 11,16	
34	WAFER	2pin,YW02502	2.00	CN 1,7	

35	WAFER	3pin,YW02503	4.00	CN 2,5,8,9	
36	WAFER	4pin,YW02504	2.00	CN 3,6	

NO	PART NAME	SPECIFICATION	Q'TY	REFERENCE NUMBER	REMARK
37	WAFER	5pin,YW02505	1.00	CN 10	
38	WAFER	7pin,YW02507	1.00	CN 13	
39	WAFER	8pin,YW02508	1.00	CN 12	
40	I.C.SOCKET		1.00	U12	
41	TR insulation		2.00	Q15,16 ASS' Y	
42	TRANSISTOR(MOT.PHI)	2N2219 CAN TYPE	1.00	Q15	
43	TRANSISTOR(MOT.PHI)	2N2905 CAN TYPE	1.00	Q16	
44	TRANSISTOR	2N3563	1.00	Q4	
45	TRANSISTOR	2N5771	1.00	Q3	
46	TRANSISTOR(MOTO)	2N3904	4.00	Q2,7,12,13	
47	TRANSISTOR(MOTO)	2N3906	6.00	Q1,14,17,19,20,21	
48	TRANSISTOR,SMD	2SA1015/1266(1504)	7.00	Q22-28	
49	TRANSISTOR,SMD	2SC1815/3198(3875)	4.00	Q8,9,10,11	
50	FET(SIL.MOTO)	2N5486	1.00	Q18	
51	FET(TOSHIBA)	K30A-Y	2.00	Q5,6	
52	C/F. RESISTOR	10J, 1/2W	2.00	R67,68	
53	C/F. RESISTOR	100J, 1/2W	2.00	R61,62	
54	C/F. RESISTOR	1KJ, 1/2W	1.00	R58	
55	C/F, RESISTOR.SMD	0 ohm / J ,1/8W	7.00	R153-159	
56	C/F. RESISTOR.SMD	10J, 1/8W	3.00	R18,44,69	
57	C/F. RESISTOR.SMD	100J, 1/8W	1.00	R45	
58	C/F. RESISTOR.SMD	1KJ, 1/8W	11.00	R2,3,8,20,21,26,35,36,38,42,70	
59	C/F. RESISTOR.SMD	10KJ, 1/8W	5.00	R1,14,15,77,83	
60	C/F. RESISTOR.SMD	100KJ, 1/8W	1.00	R85	
61	C/F. RESISTOR.SMD	11KJ, 1/8W	2.00	R23,25	
62	C/F. RESISTOR.SMD	120J, 1/8W	2.00	R47,103	
63	C/F. RESISTOR.SMD	150J, 1/8W	2.00	R88,92	
64	C/F. RESISTOR.SMD	1.5KJ, 1/8W	2.00	R19,43	
65	C/F. RESISTOR.SMD	1.8KJ, 1/8W	1.00	R32	
66	C/F. RESISTOR.SMD	2KJ, 1/8W	2.00	R33,46	
67	C/F. RESISTOR.SMD	22J, 1/8W	5.00	R28,59,60,79,102	
68	C/F. RESISTOR.SMD	220J, 1/8W	4.00	R4,29,31,50	
69	C/F. RESISTOR.SMD	22KJ, 1/8W	1.00	R89	
70	C/F. RESISTOR.SMD	240J, 1/8W	1.00	R64	
71	C/F. RESISTOR.SMD	270J, 1/8W	1.00	R49	

72	C/F. RESISTOR.SMD	2.7KJ, 1/8W	2.00	R6,11	
73	C/F. RESISTOR.SMD	300J, 1/8W	1.00	R39	

NO	PART NAME	SPECIFICATION	Q'TY	REFERENCE NUMBER	REMARK
74	C/F. RESISTOR.SMD	33J, 1/8W	2.00	R27,72	
75	C/F. RESISTOR.SMD	330J, 1/8W	4.00	R34,95,98,99	
76	C/F. RESISTOR.SMD	3.3KJ, 1/8W	1.00	R78	
77	C/F. RESISTOR.SMD	33KJ, 1/8W	1.00	R40	
78	C/F. RESISTOR.SMD	39KJ, 1/8W	1.00	R71	
79	C/F. RESISTOR.SMD	430J, 1/8W	2.00	R22,24	
80	C/F. RESISTOR.SMD	47J, 1/8W	1.00	R114	
81	C/F. RESISTOR.SMD	470J, 1/8W	11.00	R54,55,80,81,93,94,96,97,100,101,108	
82	C/F. RESISTOR.SMD	4.7KJ, 1/8W	2.00	R30,53	
83	C/F. RESISTOR.SMD	510J, 1/8W	3.00	R41,86,87	
84	C/F. RESISTOR.SMD	5.1KJ, 1/8W	3.00	R74,75,76	
85	C/F. RESISTOR.SMD	62J, 1/8W	2.00	R63,65	
86	C/F. RESISTOR.SMD	6.8KJ, 1/8W	1.00	R57	
87	C/F. RESISTOR.SMD	750J, 1/8W	3.00	R37,48,56	
88	C/F. RESISTOR.SMD	7.5KJ, 1/8W	4.00	R7,51,52,73	
89	C/F. RESISTOR.SMD	8.2KJ, 1/8W	1.00	R104	
90	SEMI-FIXED RESISTOR	VZ067TH1, 100B	2.00	SFR11,14	
91	SEMI-FIXED RESISTOR	VZ067TH1, 1KB	3.00	SFR9,10,13	
92	SEMI-FIXED RESISTOR	VZ067TH1, 10KB	3.00	SFR6,7,16	
93	SEMI-FIXED RESISTOR	VZ067TH1, 100KB	1.00	SFR12	
94	SEMI-FIXED RESISTOR	VZ067TH1, 2KB	1.00	SFR8	
95	SEMI-FIXED RESISTOR	VZ067TH1, 5KB	5.00	SFR1,2,3,4,5	
96	M/F. RESISTOR.SMD	215KF, 1/8W	2.00	R13,17	
97	M/F. RESISTOR,SMD	2.2KF, 1/8W	6.00	R9,10,12,16,90,91	
98	OXIDE FILM RESISTOR	560J, 1W	1.00	R66	
99	KEY SWITCH	SPUN90X1C021	1.00	9KEY	
100	KEY SWITCH	SPUN40X1C041	1.00	4KEY	
101	POWER SWITCH	JPP2295MDA,250V4A	1.00	POWER S/W	
102	I.C.(TI)	SN75107AN	1.00	U3	
103	I.C.SMD	LM324(TI.SGS.NS.HIT)	2.00	U1,2	
104	I.C.(SAM.MOTO.NS.)	MC7805	1.00	U6	
105	I.C.(SAM.MOTO)	MC7815	1.00	U5	
106	I.C.(SAM.MOTO)	MC7915	1.00	U7	
107	I.C.(MOTO.)	MC10116	1.00	U8	
108	I.C.SMD(SIG)	SN7400/SN74S00	1.00	U4	

109	I.C.(TI.NS)	SN7426	1.00	U16	
110	I.C.SMD(NS.HIT.PHI.)	SN74HC393	2.00	U10,11	
111	I.C.SMD(NS.HIT.SGS.)	SN74HC138	1.00	U14	

NO	PART NAME	SPECIFICATION	Q'TY	REFERENCE NUMBER	REMARK
112	I.C.(TOSHIBA)	TD62783AP	1.00	U13	
113	I.C.(AMD)	GAL16V8	1.00	U9	
114	WIRE ASS'Y(1015#22)	GND WIRE,250mm,LUG.	1.00		
115	WIRE ASS'Y(1365#30)	IN PUT CABLE,250mm	1.00		
116	CRYSTAL		1.00	X1	
117	MAIN PCB	8202-M07	1.00	* 8202M-07	
118	SHIELD CASE	Zn-pl 0.3t 60x50x16	1.00		
119	SCREW, TAPPING	T3x6BH,ZN-PL	4.00	Heatsink ass' y	
120	SPRING, COIL	6x2x7(SHIELD)	1.00	SOLDER side	
121	HEAT SINK		2.00	Q15,16 ASS'Y	
122	HEAT SINK	78SERIES	3.00	U 5,6,7 ASS'Y	

2. DISPLAY BOARD

NO	PART NAME	SPECIFICATION	Q'TY	REFERENCE NUMBER	REMARK
1	WAFER	7pin,YW02507	1.00	CN13'	
2	WAFER	8pin,YW02508	1.00	CN12'	
3	FND(hp)	HDSP-K513#001	3.00	FND1,2,3	
4	LED(LI-TON)	LTA9234(5x5x10)	5.00	LED 1,2,3,4,5	
5	DISPLAY PCB(80SER.)	8202N-DIS-03	1.00		

3. VR PCB BOARD

NO	PART NAME	SPECIFICATION	Q'TY	REFERENCE NUMBER	REMARK
1	WAFER	2pin,YW02502	1.00	CN7	
2	WAFER	3pin,YW02503	4.00	CN', CN5',CN8',CN9'	
3	WAFER	4pin,YW02504	2.00	CN3',6'	
4	WAFER	5pin,YW02505	1.00	CN10'	
5	C/F. RESISTOR	33J, 1/4W	1.00	R163	
6	C/F. RESISTOR	47J, 1/4W	1.00	R82	
7	VARIABLE RESISTOR	V16L4(7x5)S15KCB1K	1.00	TTL/CMOS	
8	VARIABLE RESISTOR	V16L4(7x5)S15KCB10K	2.00	SWEEP WIDTH,DC OFFSET	
9	VARIABLE RESISTOR	V16L4(7x5)S15KCB50K	1.00	SYM	
10	VARIABLE RESISTOR	V16L4N15KCB10K	2.00	FREQUENCY	
11	VARIABLE RESISTOR	V16L4N15KCB2K	1.00	AMP	
12	VR PCB(80SER.)	8202-VR-04	1.00		

4.FRONT PANEL PART

NO	PART NAME	SPECIFICATION	Q'TY	REFERENCE NUMBER	REMARK
1	BNC CONNECTOR	BNC-RB-4CUTTING	4.00	OUTPUT,TTL,VCF, EXT COUNT	
2	WIRE ASS'Y(#24)	3-3pin 150mm	1.00	AMP	CN5-5'
3	WIRE ASS'Y(#24)	4-4pin 150mm	2.00	SYM, OFFSET	CN3-3',CN6'
4	WIRE ASS'Y(#24)	7-7pin 220mm	1.00	CN13-13'	
5	WIRE ASS'Y( )	8-8pin 220mm	1.00	CN12-12'	
6	WIRE ASS'Y( )	2pin 150mm	1.00	VCF IN – VCF BNC	
7	FRONT PANEL, ABS	BN(80SER)DAG	1.00		
8	WIRE ASS'Y( )	2pin 180mm	1.00	CN7-TTL BNC	
9	WIRE ASS'Y( )	3-3pin 150mm	3.00	FREQ, SWEEP WIDTH,RATE	CN2,8,9
10	WIRE ASS'Y( )	5-5pin 170mm	1.00	CN10-10'	
11	BRACKET, VR PCB	BN 160x25x30	1.00	VR PCB ASS'Y	
12	BRACKET, BNC	BN(80SER.)-AG/FG	1.00	BNC CONNECTOR ASS'Y	
13	KNOB,VR,ABS	BN HF380-12965	7.00	VR	
14	PLATE, FRONT, PC	8202DAG	1.00	FRONT PANEL	
15	ACRYLE FILTER	8202DAG	1.00	FRONT PANEL	
16	NUT(VR)		4.00	VR BRACKET	
17	NUT(BNC,F)		4.00	BNC CONNECTOR	
18	SCREW, TAPPING	T3x6BH, NI-PL	3.00	BNC BRACKET-FRONT	
19	SCREW, TAPPING	T3x8BH, ZN-PL	2.00	VR PCB –FRONT PANEL	
20	WASHER, PLAIN	3-12/NI-PL	2.00	VR PCB –FRONT PANEL	
21	WASHER,PLAIN(VR)	7.2x12x0.2t/NI-PL	7.00	VR BRACKET	
22	WASHER,LATCH(BNC)	9.5x13x0.5t/NI-PL	4.00	BNC CONNECTOR	
23	WASHER,PLAIN(BNC S.)	10x13x0.3t/NI-PL	4.00	BNC CONNECTOR	

5. REAR PANEL PART

NO	PART NAME	SPECIFICATION	Q'TY	REFERENCE NUMBER	REMARK
1	FUSE HOLDER	R3-11,BN	1.00	REAR PANEL	
2	FUSE	250V/200mA (20m/m)	1.00	FUSE HOLDER IN	
3	GND CONNECTOR		1.00	REAR PANEL	
4	AC INLET(SAM IL)	NFU-101,NOISE FILTER	1.00	REAR PANEL	
5	REGULATOR 절연지	13x20	1.00	U15	
6	POWER TRANS	FG-7202	1.00	REAR PANEL	
7	I.C.(SAM.MOTO.NS.)	MC7805	1.00	U15	

8	HEAT TUBE	Pi5 x 15 mm	5.00	FUSE HOLDER	
9	HEAT TUBE	Pi 12 x 60 mm	1.00	AC INLET	
10	WIRE ASS'Y(1015#22)	GND WIRE,150mm,LUG	2.00	GND CONNECTOR	
11	WIRE ASS'Y(1015#22)	DIW,120mm,BLACK	1.00	AC INLET	
12	WIRE ASS'Y(1015#22)	3pin 2wire 200mm	1.00	POWER	

NO	PART NAME	SPECIFICATION	Q'TY	REFERENCE NUMBER	REMARK
13	REAR PANEL, PRESS	BN-DAG, FG/AG(70SER)	1.00		
14	NUT(GND TERMINAL)	INCH	2.00	GND CONNECTOR	
15	NUT	M3, NI-PL	5.00	U15 ASS'	
16	SCREW, MACHINE	M3x10BH,흑착색	2.00	AC INLET	
17	SCREW, MACHINE	M3x8BH-W, NI-PL	2.00	TRANS	
18	WASHER, PLAIN	3-10/ NI-PL	4.00	GND CONNECTOR	
19	WASHER, SPRING	3-5, /ZN-PL	6.00	U15	
20	WASHER, LATCH	4x6.5x0.3t	1.00	GND CONNECTOR	

6.OTHERS

NO	PART NAME	SPECIFICATION	Q'TY	REFERENCE NUMBER	REMARK
1	CABLE TIE	100mm, WHITE	7.00		
2	BOTTOM CASE, ABS	BN(80SER)-DAG	1.00		
3	TOP CASE, ABS	BN(80SER)-DAG	1.00		
4	RUBBER FOOT	BN-DAG,37x8.5	2.00	BOTTOM CASE	
5	RUBBER FOOT	BN-DAG,32x8.5	2.00	TOP CASE	
6	HANDLE, ABS	BN(80SER)-DAG	1.00		
7	SHIELD PLATE	BN-DAG, 250X180	2.00	TOP ,BOTTOM CASE	
8	KNOB, POWER, ABS	BN-DAG(80SER.)	1.00	POWER S/W	
9	KNOB, PUSH S/W, ABS	BN(80SER.)-DAG	13.00	KEY S/W	
10	SCREW, MACHINE	M4x45BH, ZN-PL	4.00	CASE (TOP-BOTTOM)	
11	SCREW, TAPPING	T3x8BH, H6, NI-PL	3.00	BOTTOM CASE-MAIN PCB	
12	SCREW, TAPPING	T3x6BH, NI-PL	1.00	TOP CASE-GND WIRE	
13	SPRING, COIL	Pi10x6.2, BN-DAG	1.00	TOP CASE-GND WIRE	

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FIG.5-1(A)　CIRCUIT DIAGRAM(GENERATOR PART)

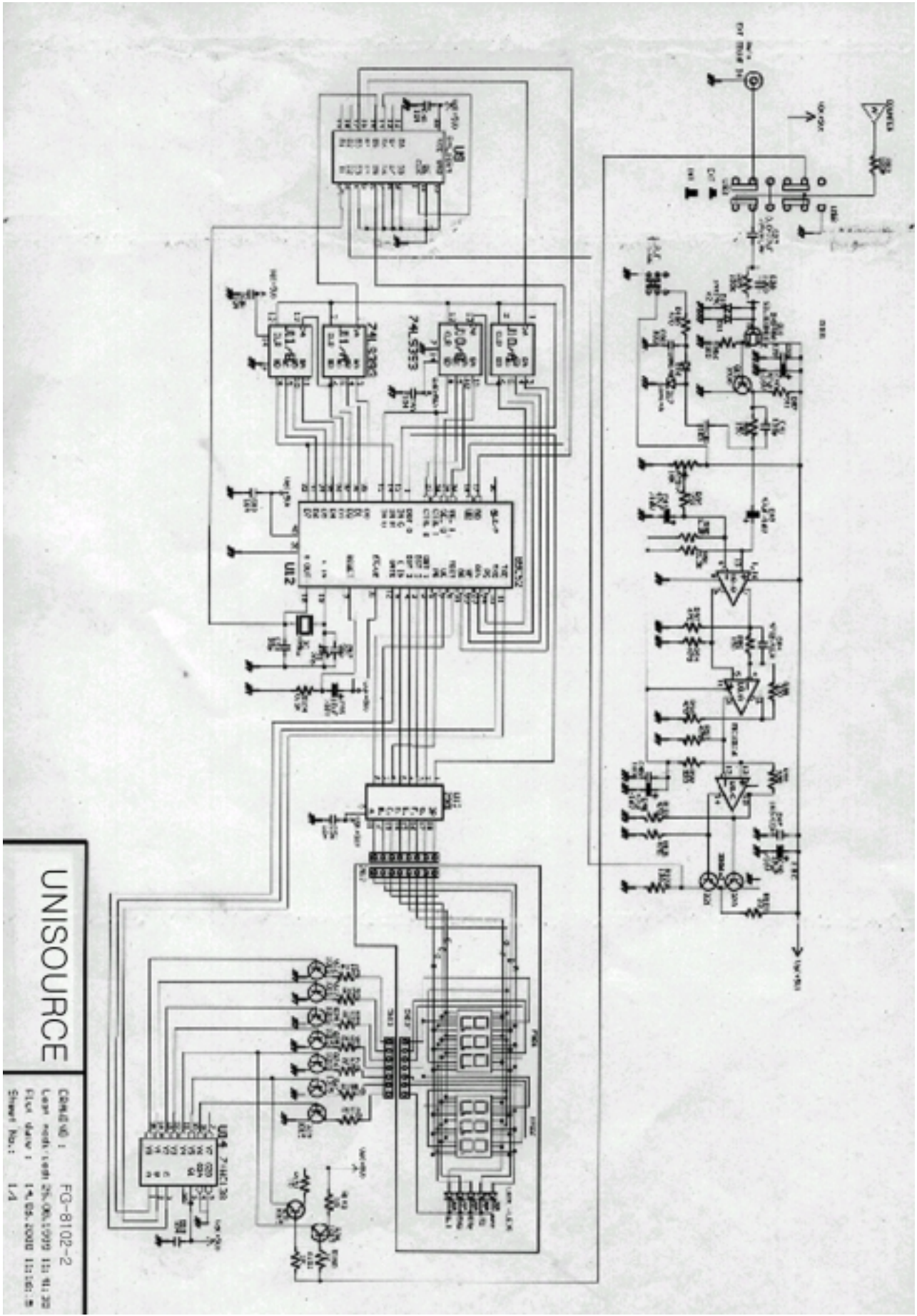

FIG. 5-1(B) CIRCUIT DIAGRAM(COUNTER PART)